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I confirm that I understand my coursework needs to be submitted online via Google Classroom under the relevant module page before the deadline in order for my assignment to be accepted and marked. I am fully aware that late submissions will be treated as non-submission and a mark of zero will be awarded.

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1. Introduction

As times are changing 21st Century technology is serving as the backbone for this time. Software Engineering is a vital resource for advancement in terms of technology mainly the types of technologies where computer science is involved. Software Engineering is a branch in computer science where designing , developing, testing the product in a systematic order. Nowadays, anybody can learn to code and create new software, but to make the programme last longer, it must be built step-by-step. This will ensure that in the future, if there is a problem with the software, it will be simpler to deal with those issues. If we use Software Engineering for the product designing, we will keep a record of the features and it will be easier for us to study the features and look at how it was made so that when we have to maintain the software in future or update it will be easier because a manual is made while developing a software.

1.1. Coursework Description

The coursework given to us weighs around 35 percentage in our final marks in the module software engineering. The coursework requires us to make a detailed report for developing a software for an institution named as McGregor institute of Botanical Training.

In this coursework we are required to make a detailed report consisting of WBS following any development methodologies we have been taught in the classroom and a Gantt chart for it, then we must create a use case diagram for the whole software with a high-level use case for each use case and an expanded use case for two of the use case in use case diagram. Then we must make a communication diagram and a sequence diagram for a use case with each process being specified. We then must create a class diagram with a table which has all domain classes. The report needs to consist of a plan for further development of this software where we have to dot down architectural choices, Design Pattern, development plan, testing plan and maintenance plan. At last, we

need to create 15 prototypes for the software McGregor institute of Botanical Training wants.

1.2. Business Modality

In the ever-changing technological landscape of today, organizations need to adapt to survive in this cutthroat environment. By launching a platform with several use cases, our client McGregor Institute of Botanical Training hopes to increase their online visibility and income. They have been conducting business in Nepal for over 7 years. They provide several graduate and undergraduate courses in horticulture and agriculture. They also intend to develop short-term courses relating to agriculture because there has been a rapid increase in the number of persons expressing interest in studying or working in the agriculture industry.

2. Work Break-Down Structure (WBS)

A project's visual, hierarchical, and deliverable-oriented breakdown is represented by a work breakdown structure (WBS). Project managers may use this diagram to visualize all the tasks needed to finish their projects and to break down the scope of their work. (Proejct Manager)

The WBS acts as a guide, breaking down big projects into smaller tasks. It's like organizing your schoolwork into manageable steps, making things less overwhelming. Think of it as your project's coach, helping you tackle tasks one by one. Just like planning your study sessions, it keeps you focused on small steps toward success.

The work breakdown that I have done is a backbone for development. In the figure below for WBS we have kept 6 phases starting from initiation, planning then further moving on to designing the system overall structure then moving towards development, we test it then move towards deploying the system. The WBS serves an inspiration while making the Gantt chart.

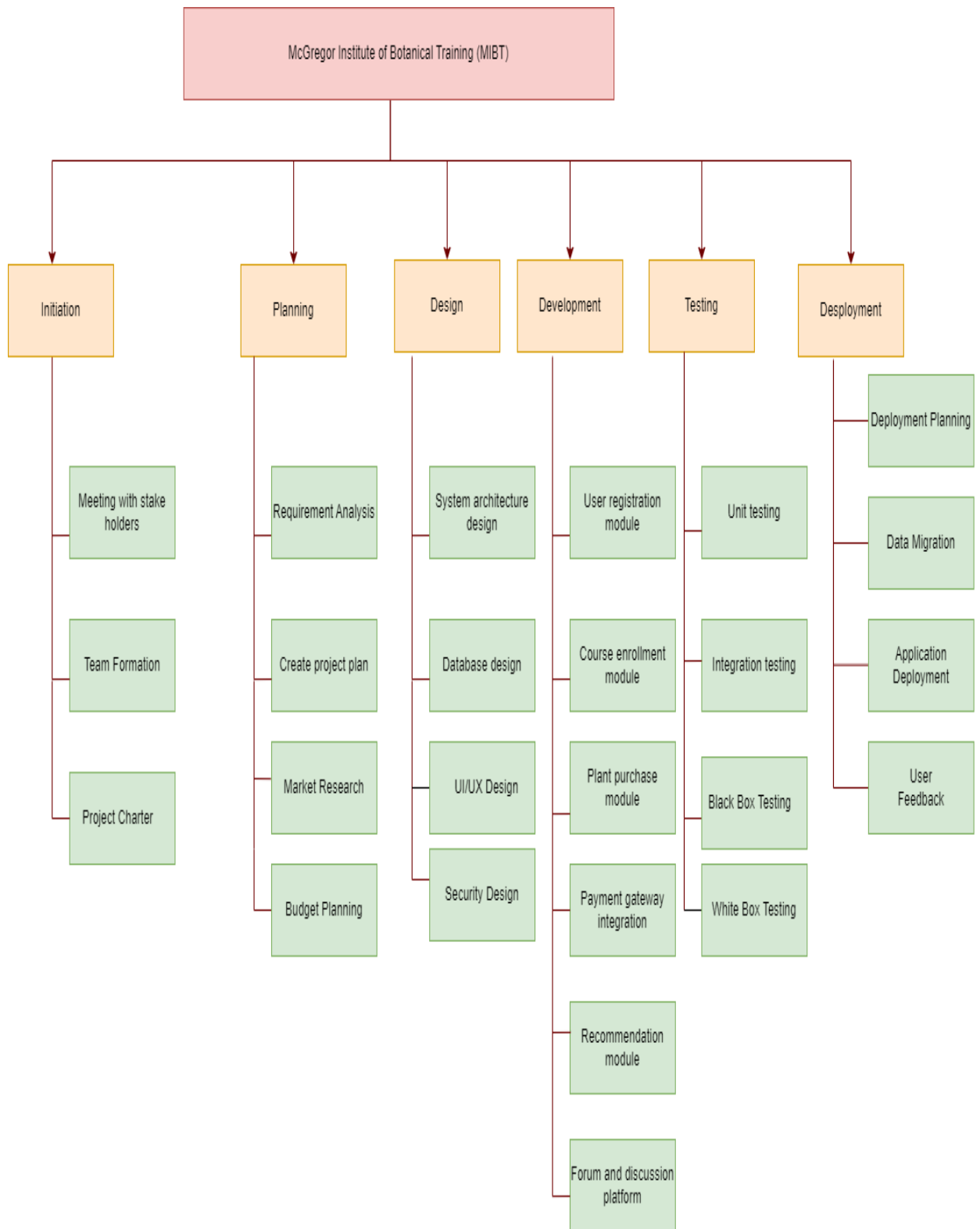


Figure 1: WBS.

3. Gannt Chart

In today's modern age one of the most important value a customer or stakeholder wants is a person or a company that delivers a correct product on correct timing that's why we use Gannt chart One tool for project management that helps with scheduling and planning projects of all sizes is the Gannt chart; they are especially helpful for visualising projects. An activity's graphical depiction with time frame is called a Gannt chart, and project managers can use it to track their progress. When there is a large team and several stakeholders, a timeline such as the Gannt chart helps to keep work on schedule. (Association For Project Management)

Gannt charts are basically project management timelines and activities that are transformed into horizontal bars, or Gannt bars, to create a bar chart. The start and finish dates, dependencies, scheduling, deadlines, amount of work performed at each step, and task owner are all displayed on these Gannt bars. Gannt charts are widely used in projects, programmes, and portfolios to display anticipated activity versus time once tasks have been defined using a Work Breakdown Structure. (Association For Project Management)

The Gannt chart which I made has various tasks which is dependent on one another for the system to be named as MIBT (McGregor Institute of Botanical Training). The system has various features in them like Registering, selling plants, taking short term courses, long term courses, unpaid courses, paid courses, joining program, engaging in forums with experts and asking for recommendation with the experts, scholars, teachers, administration taking reports of finance and user is also added. The dependencies between tasks are well established and shown in the figure and sprints are also divided generally a sprint is in between 1 to 4 weeks and the development, testing designing, and stakeholder feedback times are also well illustrated in the diagram.

The following Gannt chart serves as a roadmap for the development of MIBT (McGregor Institute of Botanical Training) system:

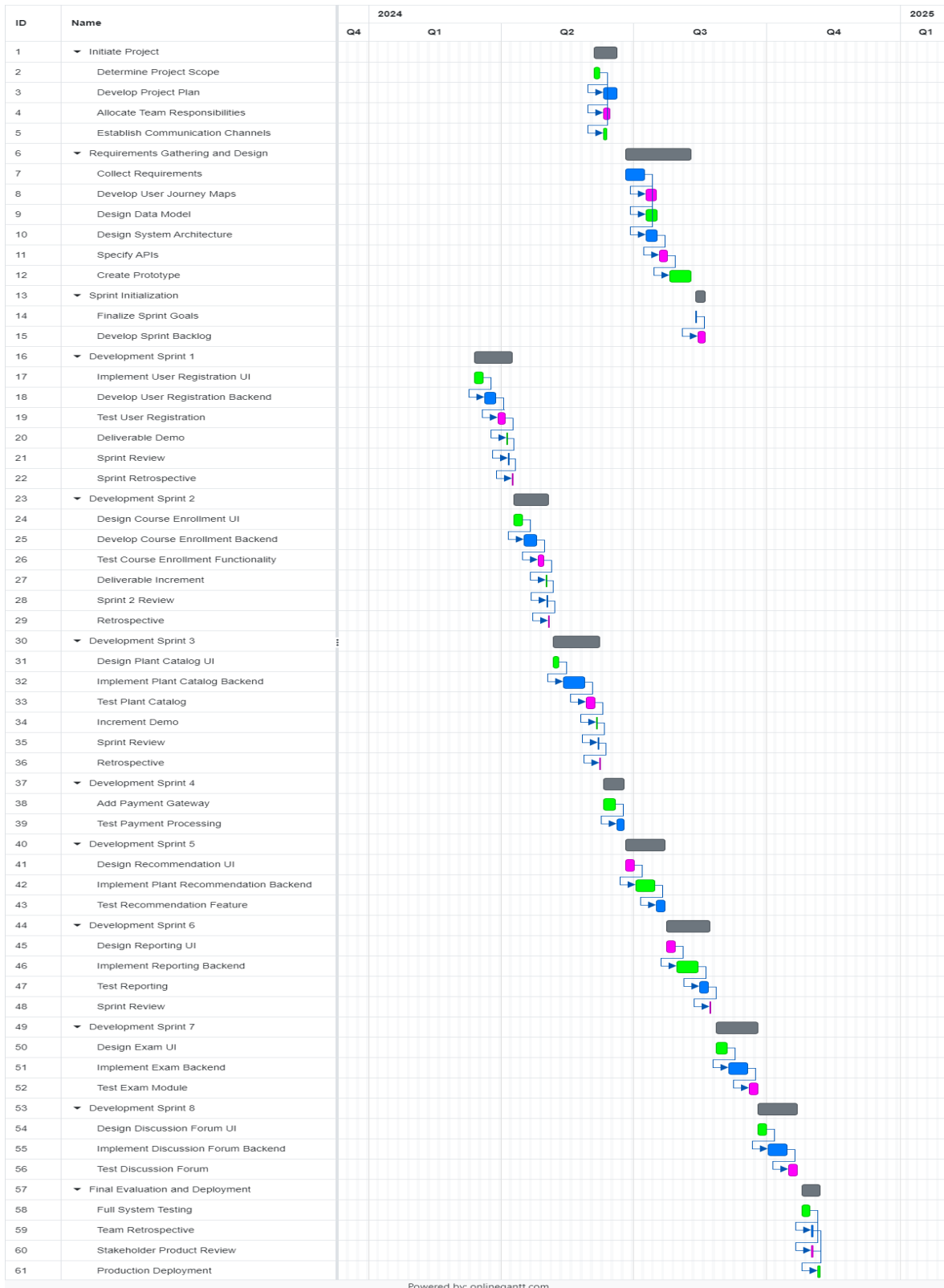



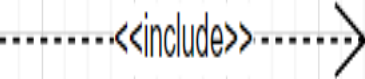


Figure 2: Gannt Chart

4. Use Case Model

A use-case model is a diagram that shows how people utilise technology to solve problems. Consequently, the use case model describes the user's objectives, their interactions with the system, and the steps the system must take in order to accomplish these objectives. (JavaPoint)

4.1. Use Case Diagram

Symbol	Name	Use
	Actor	Actor is user that uses the system, interacts in the system. It could be a person or an organization.
	Use Case	Use case is a function present in that performs in the system to achieve the goal of the system.
	Association	Association is the symbol in the diagram where the relationship in between the actor and the business use case where the actor can use the functionality.
	Include	The include relationship adds an additional functionality not specified in the base use case which must be completed for use case to be completed.

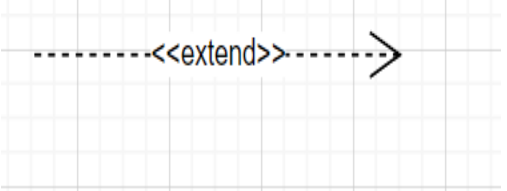
	Extend	The extension use case consists of one or several behaviour sequences that describe an additional behaviour.
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Table 1: Use Case Diagram symbol and Meaning.

The Use case diagram below shows us the specified functionalities provided to us by the specification. MIBT (McGregor Institute of Botanical Training System) provides user with main features like Registering the user, Joining Program, preparing report, Making Payments, Purchasing Plants, engaging in the forum, Taking Certification exams.

The actors in this diagram below are New user are unregistered user and user which are categorized as either students or customers (Customers who are in the application for looking at course option or to purchase plants). They are the most vital part of this system. Every action requires them because most of the features depend directly or indirectly on them.

The other actor is admin. Admins job is to approve users account and see financial reports or user reports. They are disciplinaries in the system. They have data about anything in the system.

Then another type of actor is the expert where there is teacher and scholars (Experts in a particular field). Their job is to mainly answer queries in the forum if people have any questions regarding plants or in general anything about agriculture, horticulture. Their job is to give recommendation to users about the type of plantation they can do in their geographical location.

The store is managed by a store manager. The store can have various types of users who will be buying products. They can be either students or customers who are just there to buy products, The people can also post their plants for selling

purposes. The job of the store manager is to do the job well of making the store run properly.

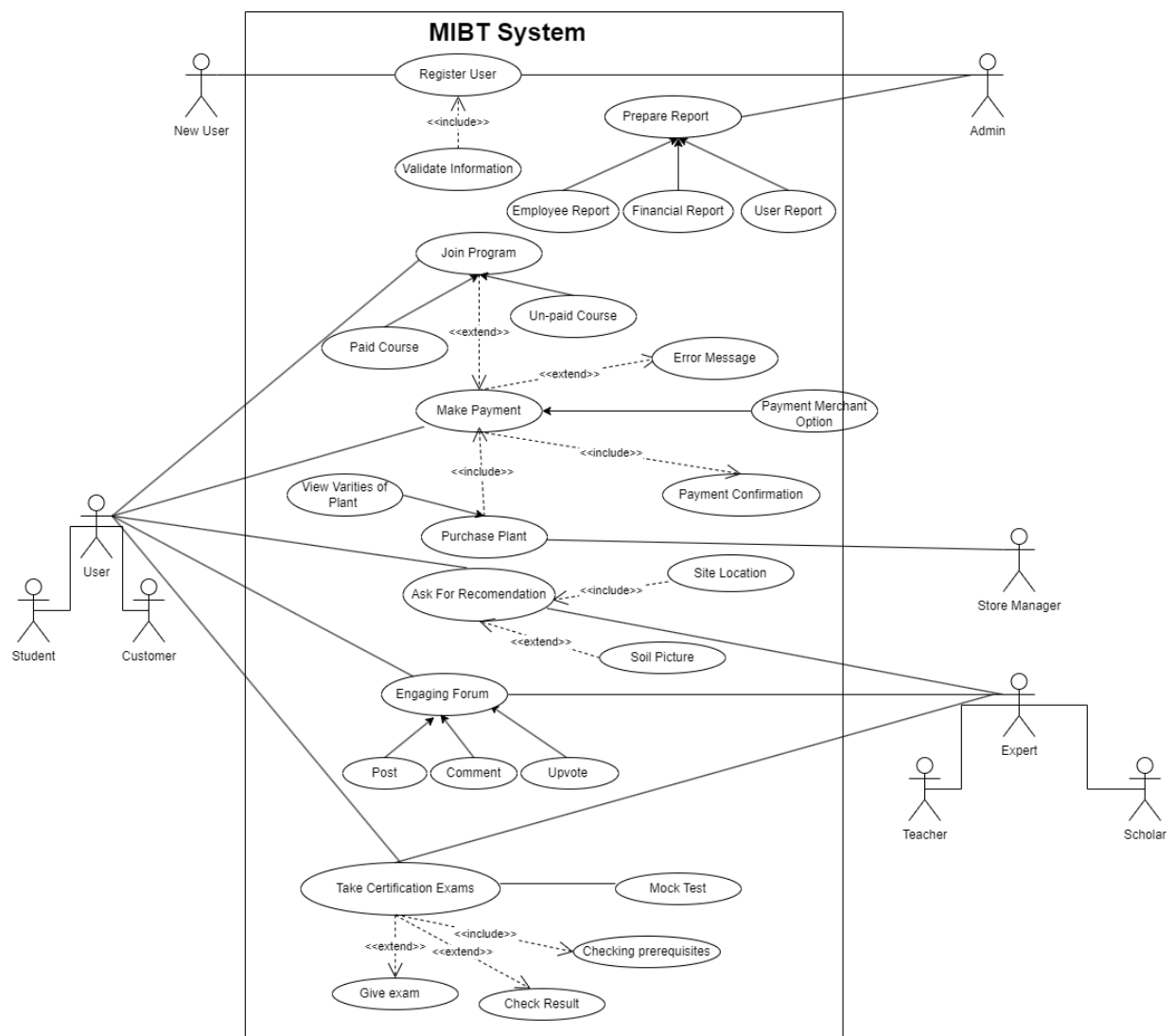


Figure 3: Use Case Diagram

4.2. High Level Use Case Description

High Level Use Case Description is a document needed for the purpose of use case where actors have been involved. It gives a overview of what is happening in the use case diagram. (Friedenthal, 2015)

4.2.1. Register User High Level Use Case Description

Use Case: Register User

Actor(s): New User, Admin

Description: A new user comes to the system, and they can Sign up to the system by simply providing the credentials in the system and the admin verifies it and registers user.

4.2.2. Prepare Report High Level Use Case Description

Use Case: Prepare Report

Actor(s): Admin

Description: The admin can look at all the activities in the system. They can check the finances and user reports by the click of a button. The reports help the company grow because they can know user activities in the system and they can emphasize on the most used activities in future.

4.2.3. Join Program High Level Use Case Description

Use Case: Join Program

Actor(s): User (Customer, Student)

Description: A user can join a program which can be under graduation, post-graduation courses through the online system. They can then make payment based on whether the course is paid or unpaid courses. The user can even have a sort button where you can choose courses based on their preferences.

4.2.4. Make Payment High Level Use Case Description

Use Case: Make Payment

Actor(s): User

Description: Whenever a user purchases a course or plant, he/she gets to pay for the service or product.

4.2.5. Ask For Recommendation High Level Use Case Description

Use Case: Ask For Recommendation

Actor(s): Expert, User

Description: In this use case a user can ask for plant recommendation to experts which is teachers and scholar in the field. The user can give the soil photos and geographical location for

4.2.6. Engaging Forum High Level Use Case Description

Use Case: Engaging Forum

Actor(s): User, Experts

Description: In this use case users can post, and comment and the Experts can do it as well which makes the forum engaging, and useful as people get to learn new things.

4.2.7. Purchase Plant High Level Use Case Description

Use Case: Purchase Plant

Actor(s): User, Store Manager

Description: User buys the product by looking at photos, price, etc. The work of store manager is to manage the inventory and the overall operations that an online store consists of.

4.2.8. Take Certification Exam High Level Use Case Description

Use Case: Take Certification Exam

Actor(s): User, Expert

Description: The users can give certificate exams even take mock tests as per their requirements and it is checked by experts. The mock tests helps the user to be prepared for final tests.

4.3. Expanded Use Case

Expanded use case descriptions show how users and the system interact. They explain specific functions and behaviours. They help understand what users need and what the system can do. They guide the development process well. They cover user roles, goals, conditions, main events, other events, and outcomes. This makes things clear and meets stakeholders' needs.

4.3.1. Expanded Use Case for Recommendation

Use Case: Ask For Recommendation

Actor(s): User, Expert

Description: In the MIBT system a user can ask for recommendation for plants if he/she is registered in the system with experts which consists of either teachers in the organization or freelance Scholar. The users can post photos of soil, queries, their geographical location, etc, based on that information the expert give a recommendation.

Actor(s) Action	System Response
1. Actor requests for exam (Either Mock test or Actual Test) in the system and enters credentials.	2. The system already has many questions in its database and questions are chosen in random orders from the question pool and a question paper is made for the user and the question paper and User information is stored so that it can be used later on while checking. The user must give exams in the site itself, so a timer has been set accordingly.
3. Actor then gives the exam on a set	4. The system then stores the answers and question in one

time frame.	document and sends it to the respective teachers for checking and if it is a MCQ test then the answers are already stored in the system so basically the system itself marks the answer. If it is a long question test, then the system requires to send the answer sheet.
5. The teacher now checks the answer and marks the student and sends the score to the system.	6. The system now takes the checked marks and stores it in database for future use and the scores is also displayed on the users panel and if the users ask for marksheet a marksheet will be made automatically by the system itself.

Table 2:Recommendation Expanded use Case

Alternative Course of Action:

Line 1-6: If the student has failed the actual test 2 times they have to restudy the course again. Mock tests can be given as much as they want but actual test is different. It can be done only twice.

Line 5-6: If the user is dissatisfied with their marks they can request of recount of their marks in the system but it can only be done once.

4.3.2. Expanded Use Case for Purchase Plant

Use Case: Purchase Plant

Actor(s): User, Store Manager

Description: The MIBT system has a store where users can purchase plants they want. They can see a catalogue of plants, based on which they can buy plants. The work of the store manager is to manage the store inventory, check if payment has been made or not when plants are purchased.

Actor(s) Action	System Response
1. User can see the catalogue of products.	2. The system displays most sold products in the system in the catalogue.
3. User can search for products in the store.	4. The system stores the search for future recommendation to user.
5. User adds product to the cart.	6. The system stores the cart information.
7. User checks out the product in the cart.	8. The system gives payment option to the user.
9. User pays for products.	10. The system stores payment data and sends it to store manager for review.
11. Store manager adds, deletes, updates product.	12. The system updates the database.

Table 3:Purchase Plant Expanded Use Case

Alternate Course of Action:

Line 5-6: The user can remove product from cart if they do not want the product.

Line 6-7: The user can return a product within 3 days or purchase or cancel order within 1 hour.

5. Collaboration Diagram

A collaboration diagram, often referred to as a communication diagram, uses the Unified Modelling Language (UML) to show the links and interactions between

software elements like UI, Objects. These diagrams may be used by developers to show the dynamic behaviour of a certain use case and specify the functions of each object. (Lewis)

The collaboration Diagram Mainly Consists of Object, UI, Actor, Message and Links.

Actor: Actors are the users or an entity of the figure that invokes interactions.

UI: UI is the forum in which users and object interacts with each other's in the system.

Object: Objects are denoted with rectangular shape, and it has object name and it follows the naming conventions of class.

Message: It is a labelled arrow which goes back and forth transferring messages between objects.

Links: It is a link between the actor and object or objects connection between each other denoted by a straight line.

Generally, in the programming that we do. We follow OOP (Object Oriented Programming) the system for MIBT will also follow OOP when it is being developed by the developers. We have made a collaboration Diagram for the Examination. Where the actor is user. The info goes through GUI to object for examination and further into user and Expert.

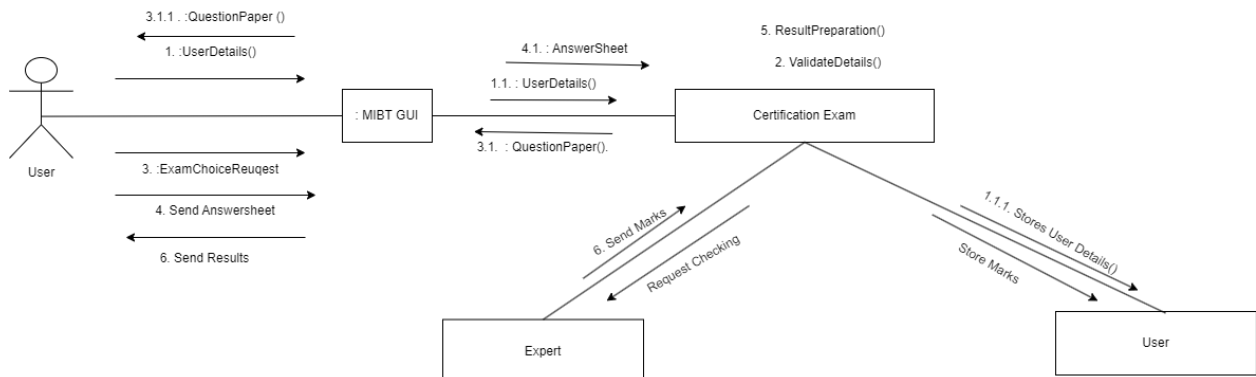


Figure 4: Collaboration Diagram

6. Sequence Diagram

An example of an interaction diagram is a sequence diagram, which shows the relationship between a set of items and their order of operation. Software engineers and business experts use these diagrams to record current processes or to comprehend needs for new systems. Event diagrams and event scenarios are other names for sequence diagrams. (Lucid Charts)

In this figure below we have a vast display of how the user data is moving and how objects help it, and these are stored in databases.

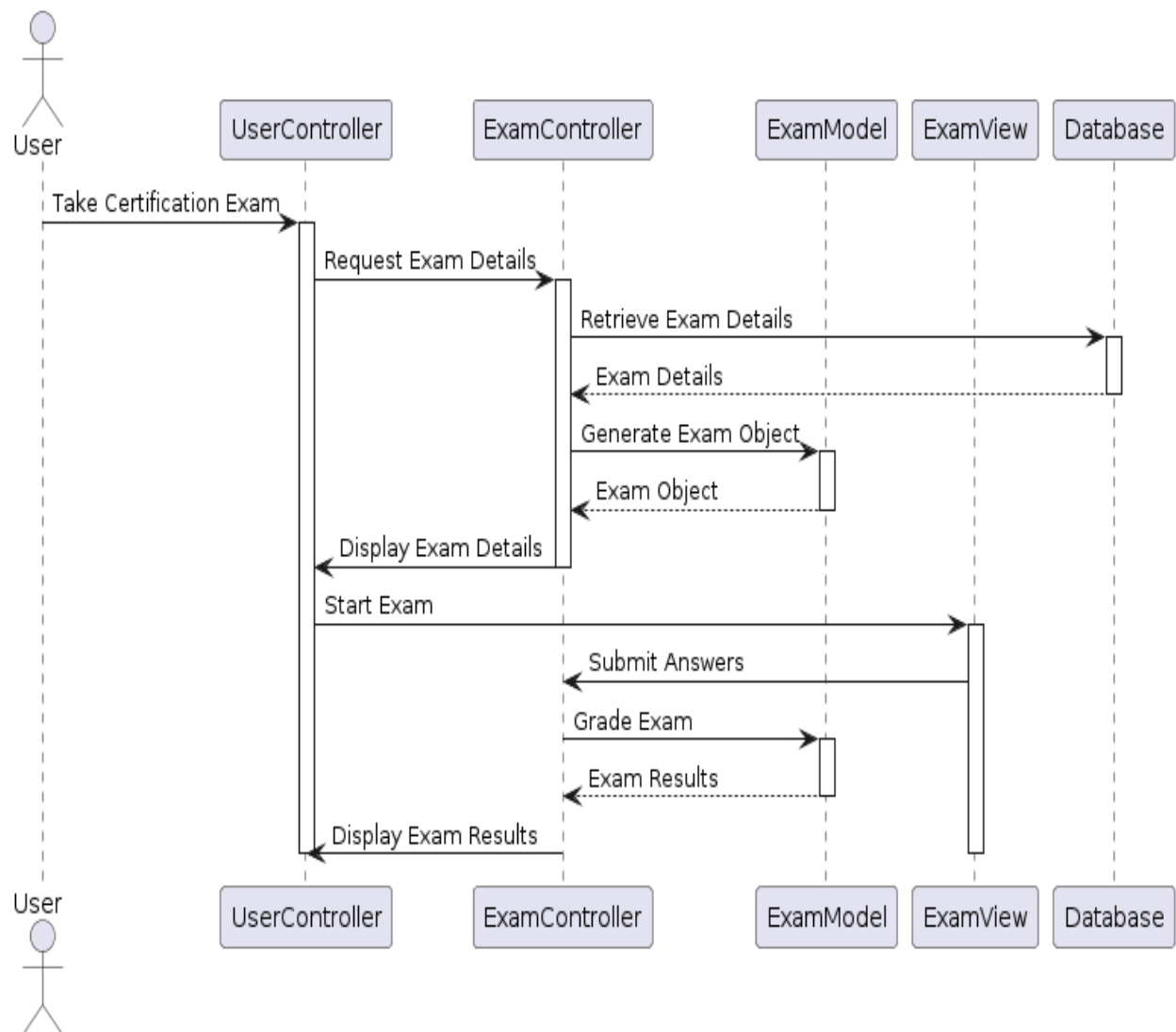
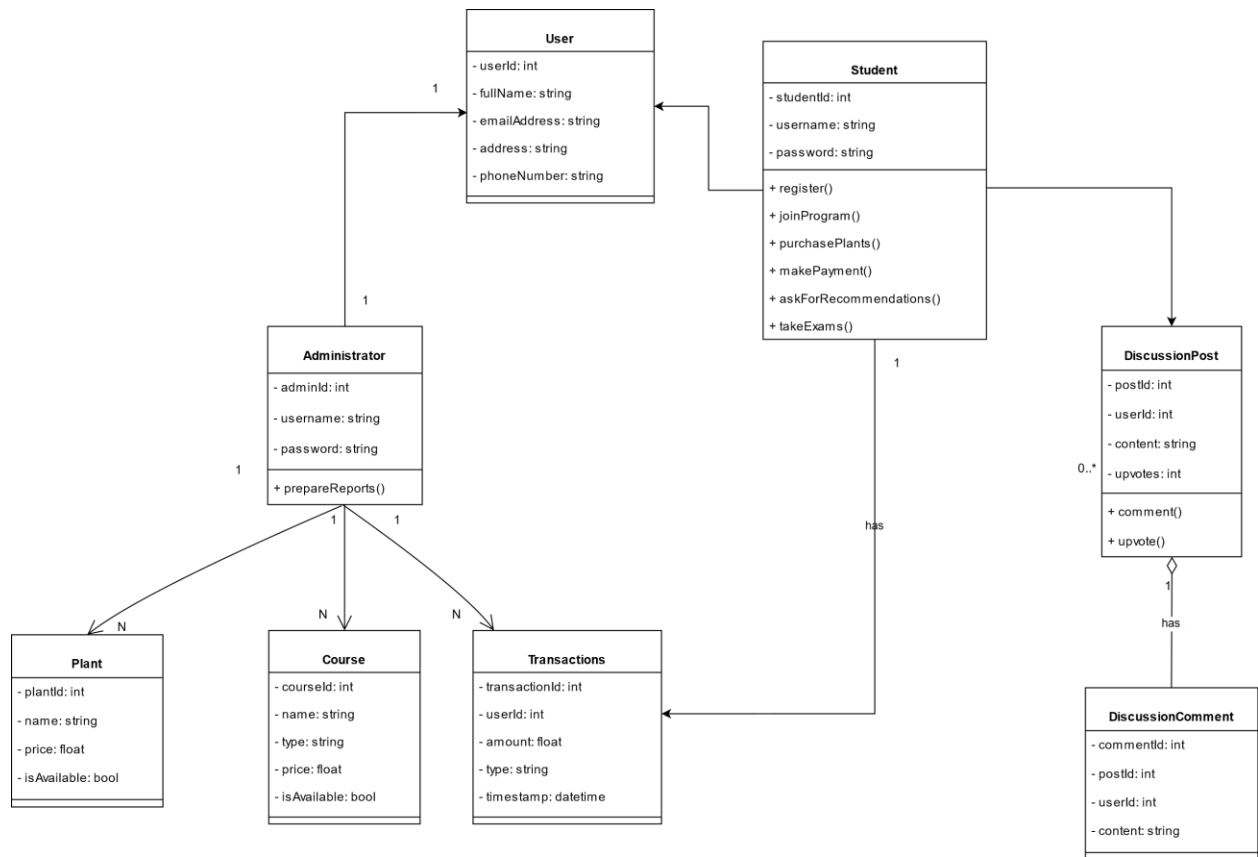


Figure 5: Sequence Diagram

7. Class Diagram

A class diagram is a graphical representation of the Structure of code and it is used to show relationship between the classes, attributes, etc. It is the main building block for Object Oriented Modeling



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Figure 6: Class Diagram

8. Further Development

The plans for MIBT (McGregor Institute of Botanical Training) are a huge task. Completing it in a well-planned manner is a big task both financially, and technically. We need a proper financier Aswell because completing this project requires a lot of expertise in the fields of Development, designing and Botanical related Knowledge as well. The app should be scalable and interactive with top notch performance.

The MIBT will be using Microservices architecture because there are a lot of services that needs to combine in one. We will be following MVC pattern where the Model will have all the calculations (Business Logic) needed, View will be the GUI, controller will have database and other in simple language controller will control both Model and view. The programming language which will be used is java script and flutter for UI and python will be also used because in the era of machine learning we need to be competing in future so from now on if we implement python it will be useful.

The system will be deployed wholly on cloud because it is necessary when we need to scale the product in the market. For this we will be using AWS because it is the most trusted cloud provider throughout the world, and it is easier to find people with AWS knowledge in the market. Further payment API needs to be added in the system for embedding apps like Khalti and esewa.

A thorough testing technique is essential to guarantee the robustness and dependability of the McGregor Institute of Botanical Training system. This means that every module and feature rom user registration to certification exam must be carefully examined to ensure that it functions and is user-friendly. Strict testing procedures will be used, such as system testing to appraise the system overall, integration testing to analyse the relationships between modules, and unit testing for specific components. In addition, acceptance testing will be carried out to make sure the system satisfies the standards and criteria of the institute. Regression testing may be completed more quickly and efficiently with the use of automated testing tools and frameworks, both black box testing and white box testing should be done,

9. Prototype

The prototypes were created in Figma. People may develop, share, and test designs for mobile applications, websites, and other digital goods and experiences using Figma design. It is a well-liked tool for writers, developers, product managers, and designers. It facilitates collaboration, feedback-giving, and quicker, better decision-making for all parties engaged in the design process.

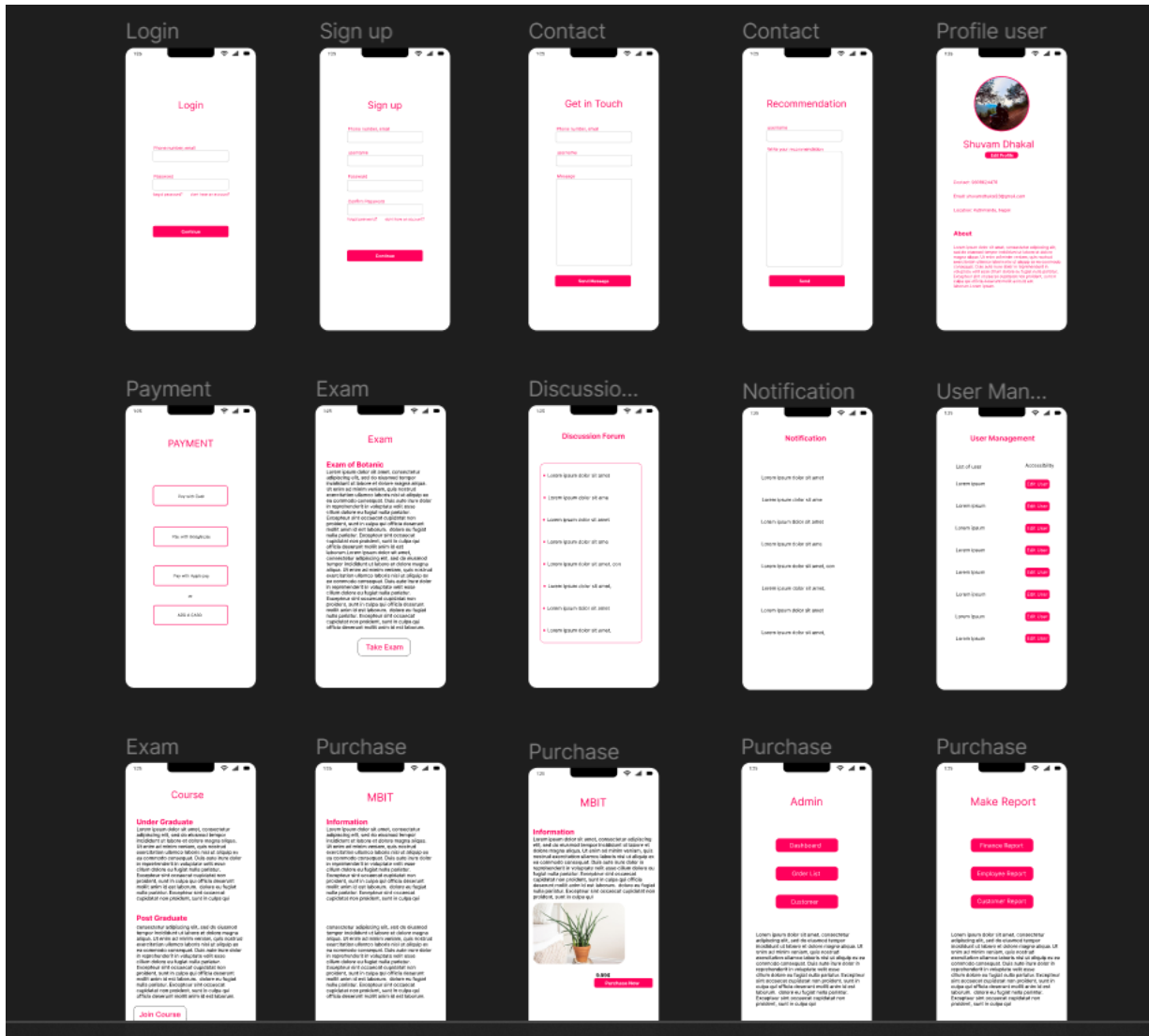
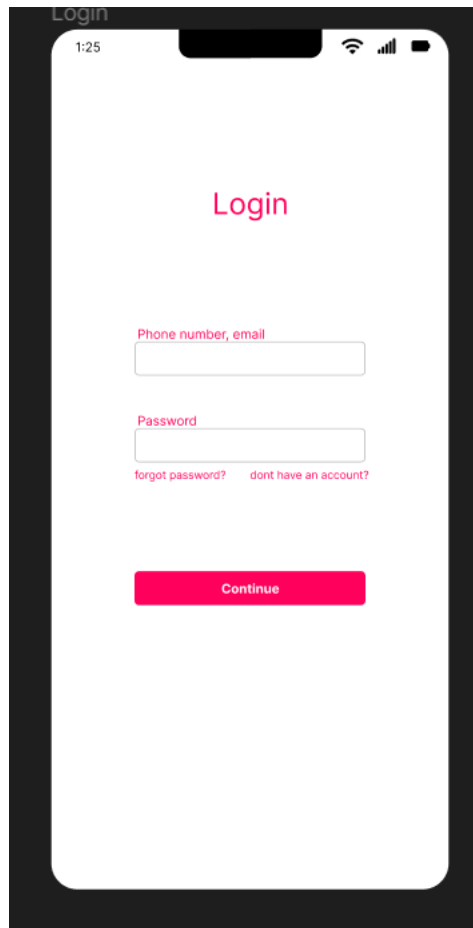


Figure 7: All the prototypes in Figma



A mobile app login screen prototype. The screen is white with a black border. At the top, the word "Login" is written in a light gray font. Below it, the time "1:25" and status icons (signal, Wi-Fi, battery) are visible. The main heading "Login" is in a bold, pink font. Below the heading, there are two input fields: the first is labeled "Phone number, email" and the second is labeled "Password", both in a small, pink font. Below the password field, there are two links: "forgot password?" and "dont have an account?", both in a small, pink font. At the bottom, there is a pink button with the word "Continue" in white text.

Figure 8: Login Prototype

Sign up

1:25

Phone number, email

username

Password

Confirm Password

forgot password? dont have an account?

Continue

Figure 9: Signup Prototype

Contact

1:25

Get in Touch

Phone number, email

username

Message

Send Message

Figure 10: Messaging Option Prototype

Contact

1:25

Recommendation

username

Write your recommendation

Send

Figure 11: Recommendation Prototype

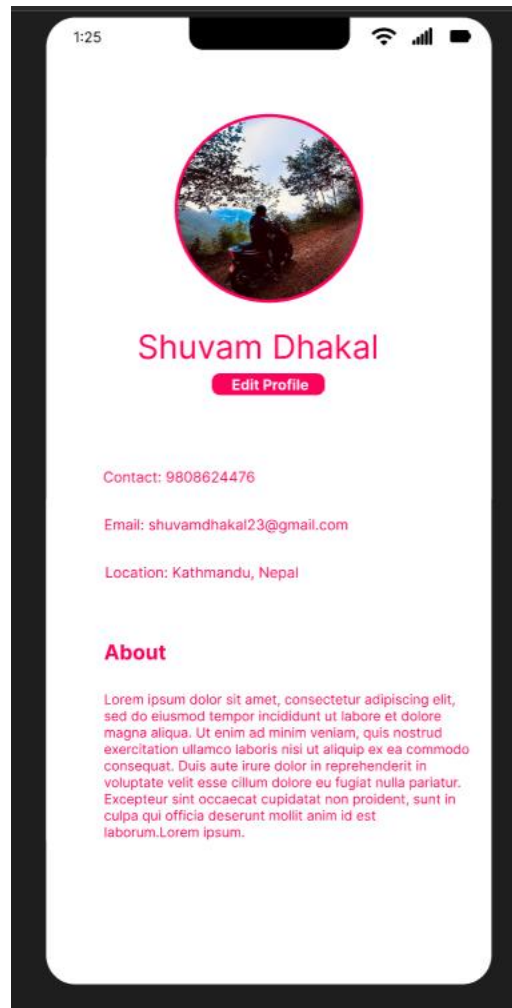


Figure 12: User Profile Prototype

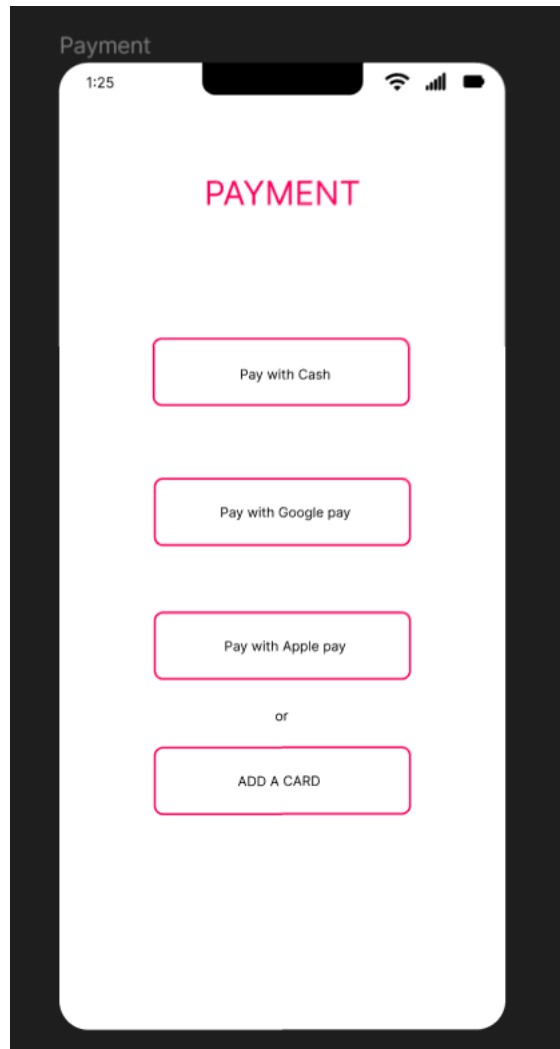


Figure 13: Payment Option Prototype

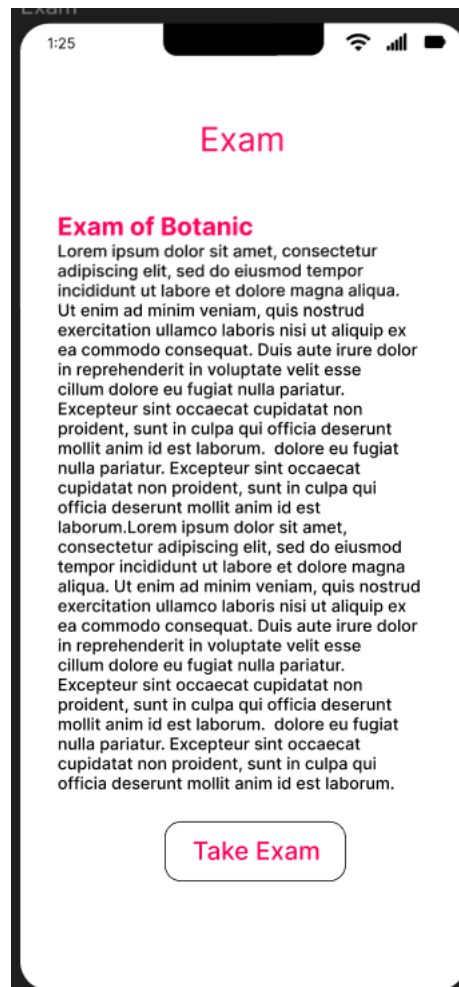


Figure 14: Exam Prototype

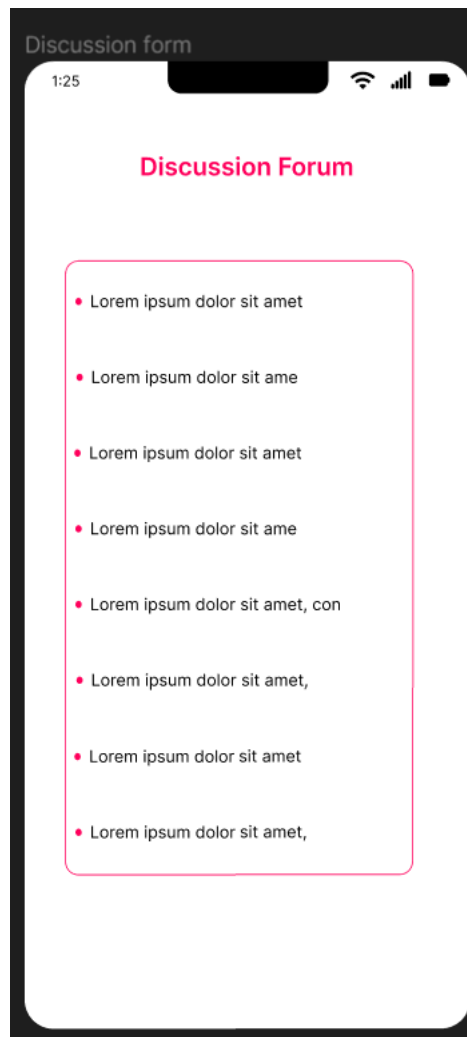


Figure 15: Discussion Forum Prototype

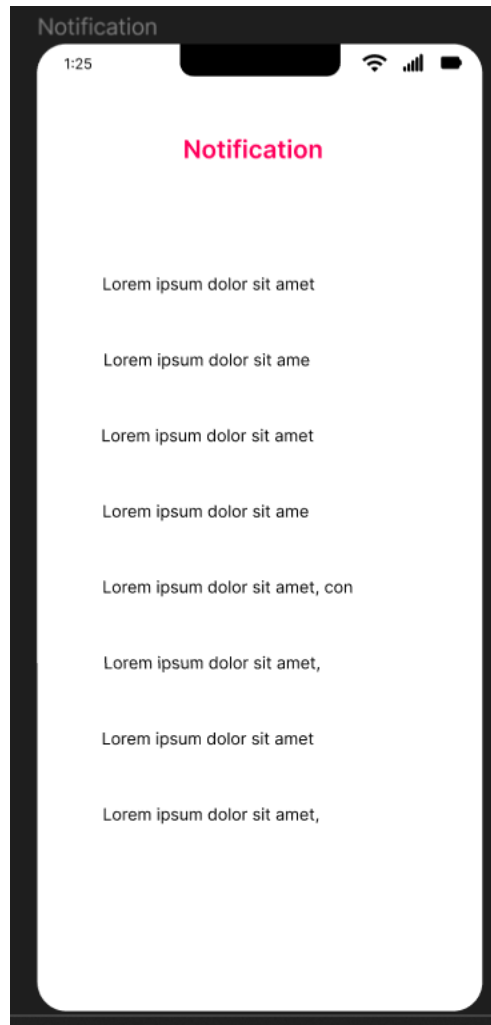


Figure 16: Notification Prototype

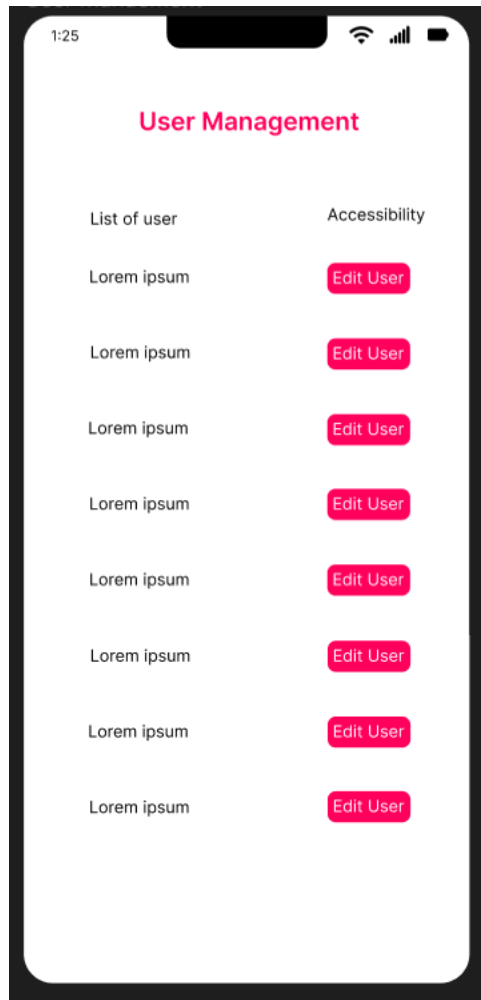


Figure 17: User Management for Admin Prototype



Figure 18: Join Course Prototype



Figure 19: Information Page Prototype

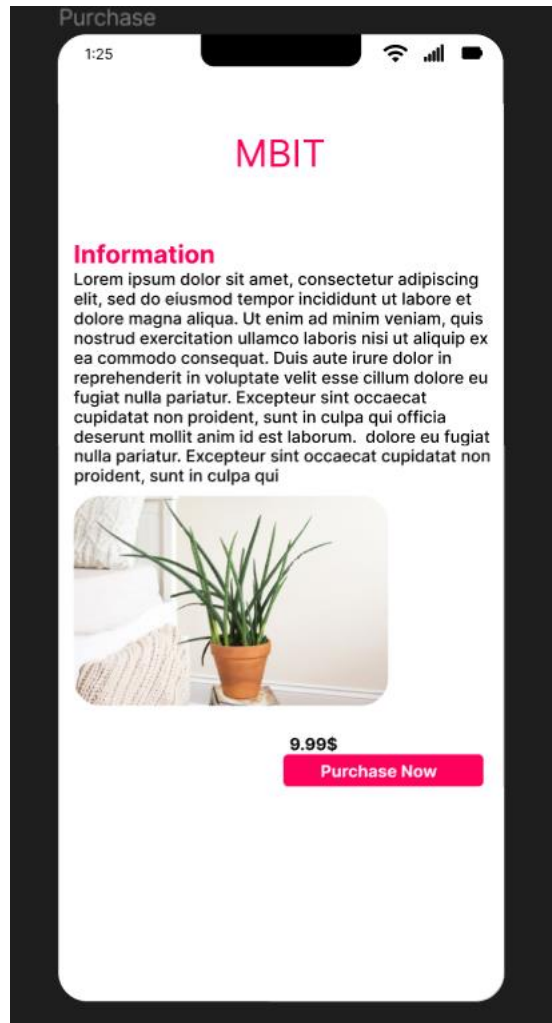


Figure 20: Plant Purchase Prototype

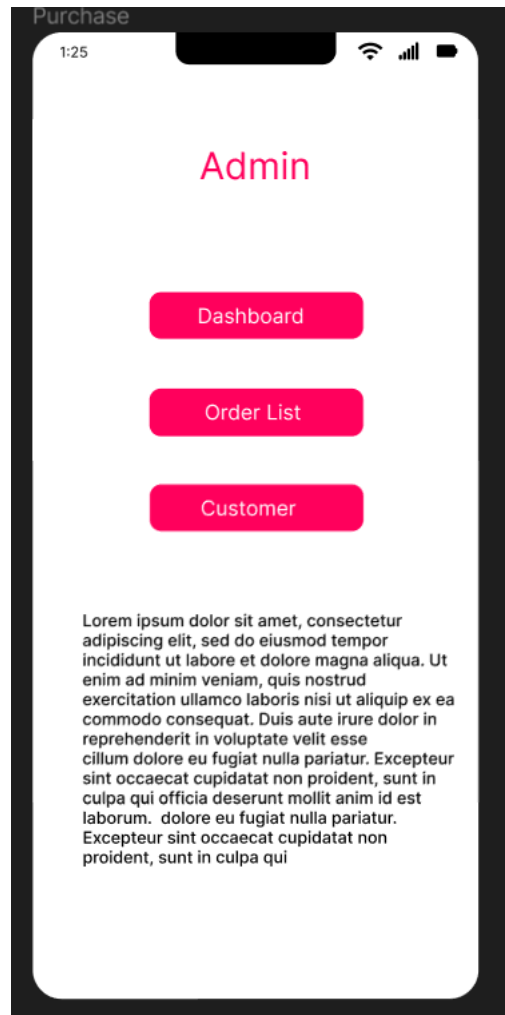


Figure 21:Admin Panel Prototype

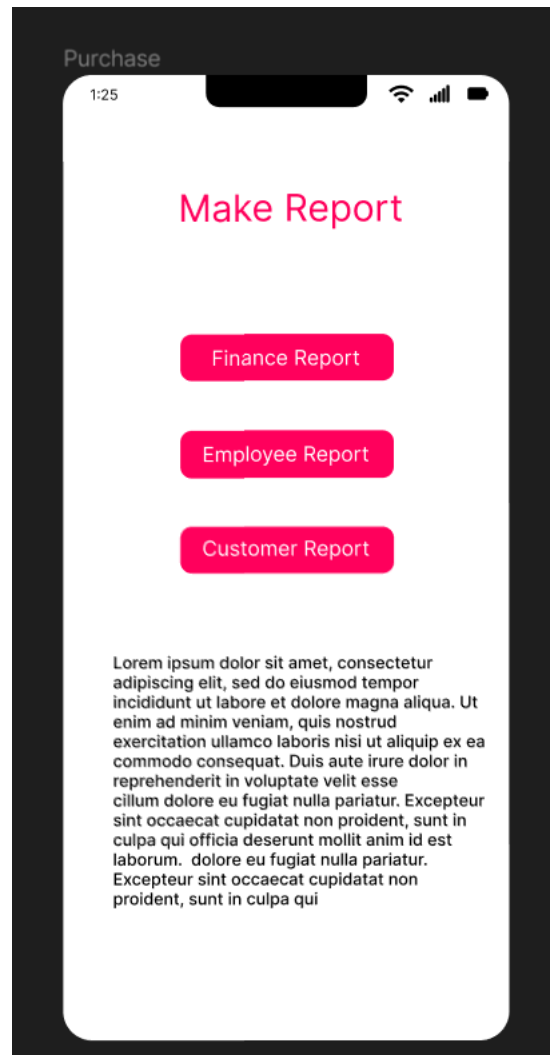


Figure 22: Make Report Admin Panel

10. Conclusion

The coursework was not a piece of cake for us. We had to do a lot of research on this coursework. I would Like to Thank our teachers for constant support and feedback on this work. The most challenging part was to make prototypes as I was not so much aware with Figma website.

I reviewed a lot of websites for searching new things and it was not an easy task to get all the resources intact. It was a tedious Task but overall, I have gained a lot of things while completing this work. The good part is that now I have some idea of how an industry works what are the documents needed when making a software thinking of the future. We use social media, but we never think how it operates in the background. There is a ton of effort time given by the companies to develop even small features.

The coursework primary goals were to provide a framework on which now a software can be delivered to MIBT the institute and I think that I have completed my work sincerely following the guidelines provided to us by our teachers.

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